

# TALLAHASSEE AREA MINIMUM TEMPERATURE STUDY

## Monthly Report-February 2002

### National Weather Service-Tallahassee Department of Meteorology, Florida State University

#### Introduction

This is the third monthly report describing minimum temperatures in the Tallahassee area. It is part of a long-term joint research project between the National Weather Service, Tallahassee and the Florida State University Department of Meteorology.

#### February 2002

The February 30 year average minimum temperature at the Tallahassee airport is 42 degrees. February 2002 was somewhat cooler than normal with an average minimum of 38. Nineteen observers participated in the study, and their locations are indicated on the attached map (Fig. 1). The observer locations represent a wide spatial distribution across Leon County.

**Figure 1: Site Map**

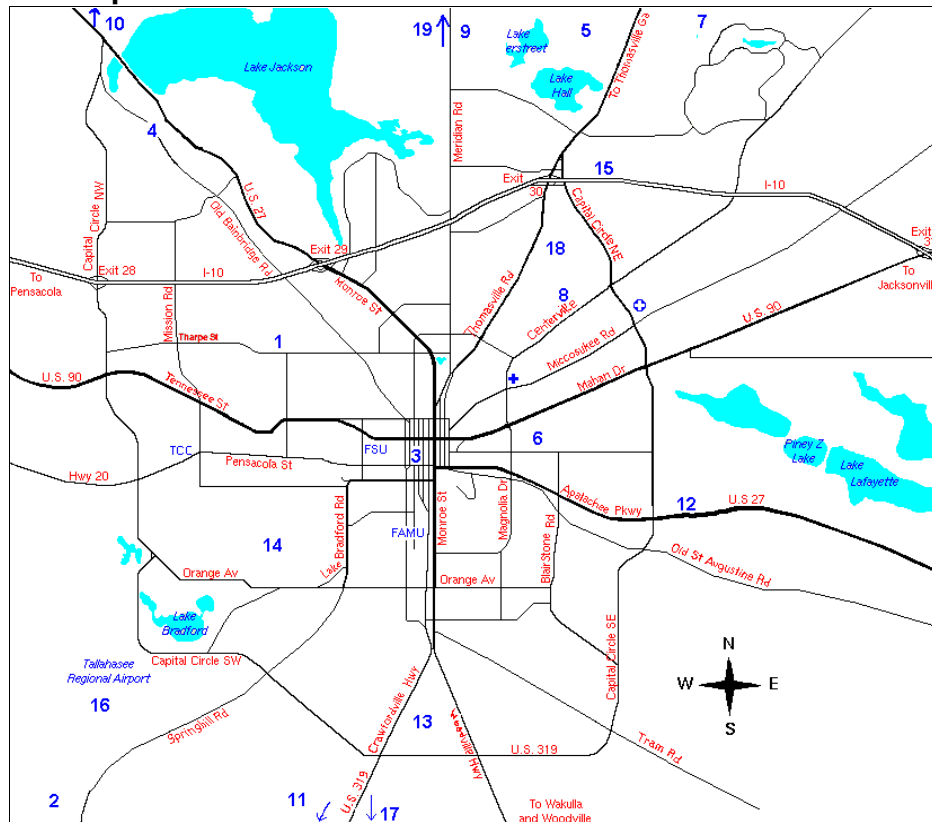


Table 1 gives raw daily minimum temperature data for each location in the network. These data can be used to compare any site with the other eighteen. The coldest readings at the airport were February 8th-9th, 17th-18th, 23rd-25th and especially the 27th-28th. Conversely, the end of January into February 1<sup>st</sup> and the 20th-22nd represented two periods of mild temperatures. These periods demonstrate how changing synoptic scenarios affect the range of minimum temperature. A wet cold front pushed through the area on the 6<sup>th</sup>-7<sup>th</sup> depositing 0.84 inches of rain. Dry or virtually dry cold fronts crossed the county on the 16th-17th, 21st-22nd and the 26th. In their wake, strong high pressure built in locally reinforcing cold air.

As usual with winter frontal passages, winds shifted from southeast to northwest, increased and became gusty before noticeably decreasing several days later. For example, winds ahead and along a strong cold front averaged 10.4 mph and 11.7 mph on the 6<sup>th</sup> and 27th, respectively and progressively decreased to 1.6 mph and 3.1 mph on the 9th and 28th, respectively. The coldest temperatures occurred several nights after the frontal passages when high pressure sank southward to the local area, and dry north winds subsided to near calm. Overnight NWS airport observations, on both the 17th-18th and on the 28th indicated clear skies and unlimited visibilities. This set up ideal conditions for radiational cooling, and the temperatures plummeted to their lowest values.

Conversely, winds on the mildest nights were from the southeast to southwest, ahead of an approaching cold front. As the high began to move east and/or south in response to the next approaching front, winds become more east then southeast, and local temperatures modified. Overnight observations indicated onshore, relatively moist low-level flow that generated dense fog with stratus ceilings generally below 500 feet. Dense airport fog was reported on the 1st, 10th, and 21st all ranking as the mildest days the month. This significantly limited outgoing radiation, resulting in unseasonably mild predawn lows in the mid 40s up to 61 degrees.

On the coldest days of the month, the Tallahassee urban heat island showed a range of 14-18 degrees on the 23rd-25th, 16-17 degrees on the 17th-18th, 16 degrees on the 28th and 10-13 degrees on the 8th-9th. This range is significant for a small city like Tallahassee, and it generally increases as winds decrease and radiational cooling increases. During the mildest nights, the ranges were generally less than ten degrees, and, as expected, smaller than during cold outbreaks. For example the range was only 5 degrees on February 1st. However, several days, most notably the 20th-22nd, showed double digit ranges. This included a 17-degree range on the 22nd highlighted by a warm front that placed the local sites alternately in the cold and warm sectors of the front. This likely accounted for the temperature ranges.

The synoptic effects on temperature ranges also can be illustrated by scatter diagrams which show the temperature spread on each day. Figure 2 shows two days, February 6th and 28th which represent very different temperature distributions. The 6th was one of the warmer days marked by overcast skies, a temperature range of only 6 degrees and relatively little scatter between observers. Conversely, the 28th was the coldest

day marked by clear skies, light winds, a 16-degree range and a significantly greater point scatter.

Table 1 is the daily raw observer data including mean and standard deviation.

Figure 3 is a station histogram which shows how each site ranks in comparison to the other eighteen sites during February 2002.

Table 2, labeled "Frequency of Extremes" smoothes out skewed results that are due to missing data. It is more informative than simple raw data or rank histograms, telling how many times (and the percentage of times) that your station ranked as one of the coldest or warmest four sites on a particular day.

One should note that four of the five coldest sites during February were also the coldest during the previous two months. These are (in order) Binkley, Canopy, Lundy and Oak Ridge. McCool replaced Chiles as the fifth site. Likewise, four of the five warmest sites this month were the same as those during the previous two months. These include (in order) Brogan, Bellenot, Fuelberg and Wakulla. Stuart replaces Lericos, as the latter has relocated.

Although more months of data still must be gathered, these results continue to strengthen the argument that selected locations tend to represent extremes in the Tallahassee urban heat island. Not surprisingly, all the coldest sites are located farthest from downtown and in the most rural parts of the county where natural surfaces predominate. Two are in the northwest, two in the south and one in the southwest quadrants. Conversely, the warmest sites are those in or closest to the downtown area, with only Wakulla located some distance south. The Tallahassee airport was one of the warmest four sites 32 percent of the time, but one of the coldest only 11 percent of the time. As in previous months, this substantiates that, contrary to popular belief, the airport does not represent a cold valley in area temperatures.

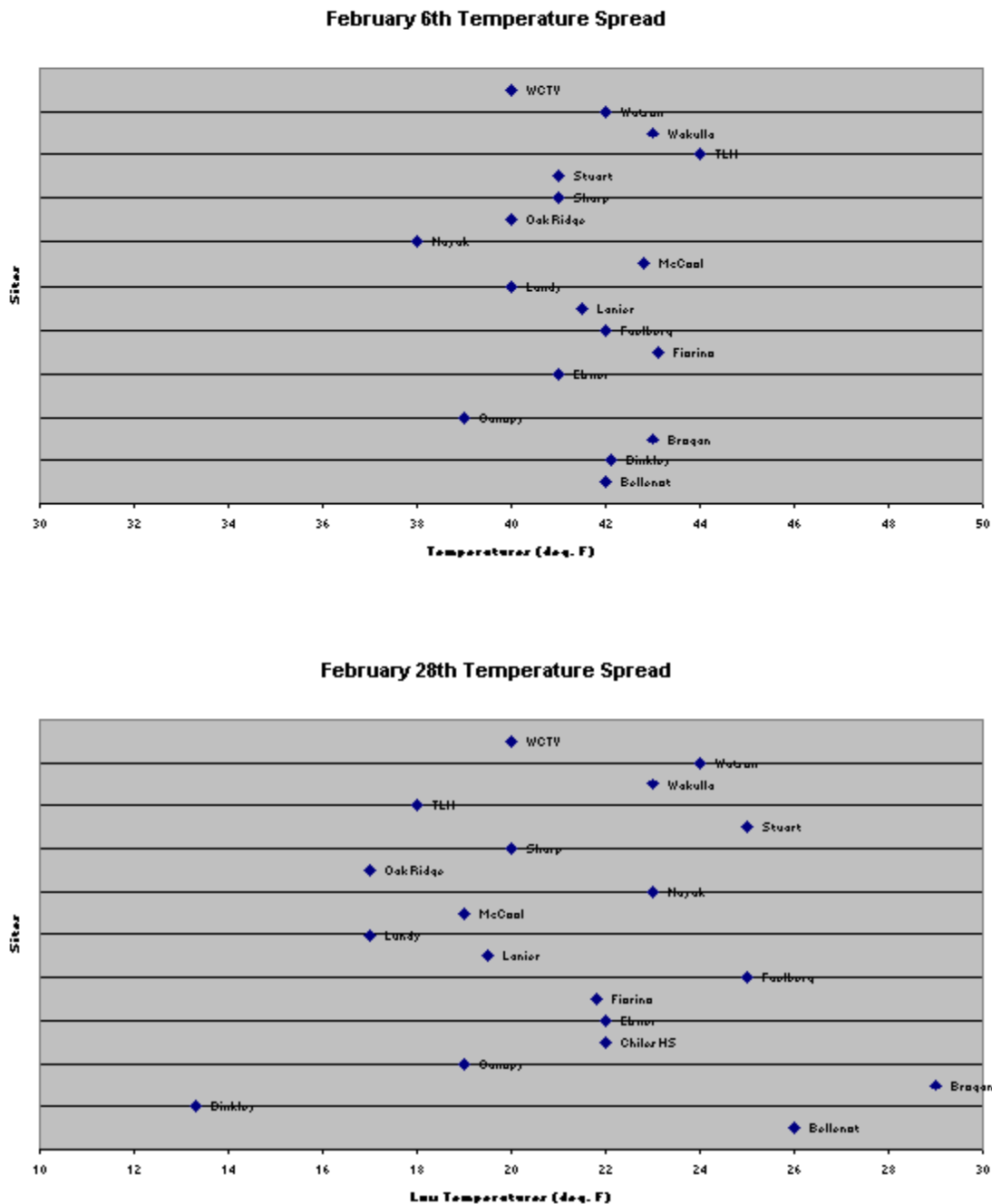
The February data continues to validate classical urban heat island studies which indicate that minimum temperatures decrease as you move away from the city center. Perhaps of greater interest is the spatial distribution of cold sites during and after a frontal passage. During a passage and the day after, when northwest and north wind speeds are strongest, locations in the northwest and north quadrants, not normally cold spots, rank amongst coldest for that day. This includes WCTV, Chiles and Sharp. However the following two days, when winds typically diminish and radiational cooling dominates, the distribution of coldest sites becomes more evenly distributed and is based more on the distance from downtown, the amount of natural surface, topography and soil type...all of which will be addressed in detail in future reports.

## **Summary**

This being only the third month of Tallahassee minimum temperature data, preliminary assessments may be modified as additional data are collected. Nevertheless, after three months, during most of the winter season, the data imply that the Tallahassee

urban heat island is more complex, and the minimum temperature ranges are more varied, than previously anticipated. Although temperatures generally decrease with distance from downtown, several factors can alter this circular distribution. In particular, the daily spatial distribution of coldest temperatures appears to be related to synoptic factors, including the effect of frontal and post-frontal weather as well as topography and land use type. Future reports will investigate the reasons for these occurrences in more detail. They also will evaluate winter 2002 data and present a seasonal report.

**Figure 2: Temperature Scatter Diagrams**



**Table 1: Raw Data**

	Feb-021	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Bellenot	6246	41	44	37	42	41	35	40	53	46	40	42	43	
2.Binkley	61.347.3	31.8	43.3	32.7	42.1	37.9	27.5	31.3	43.9	43.3	30.2	34.2	39.1	
3.Brogan	6249	45	46	40	43	42	38	44	54	49	44	48	46	
4.Canopy	59		3340	34	39	36	30	32	45	42	32	35	36	
5.Chiles HS	5841	35	39	34			3530				4333	48		
6.Elsner	6047	37	43	36	41			3334			4535	38	38	
7.Fiorino	60.340.8	36.8	38.8	38.9	43.1	38.3	33.2	34.4	48.1	39.7	34.2	37.4	38	
8.Fuelberg	6148	40	44	38	42	45	35	38	50	47	38	40	41	
9.Lanier	5845	35.5	36	36	41.5	42.5	32	37	49	44.5	33.5	36	38	
10.Lundy	6045	32	41	34	40	44	30	31	44	42	31	34	34	
11.McCool	5738.5	34.9	36.3	34	42.8	35.6	30.9	32.7	44.4	38.8	32.7	36.1	34.5	
12.Nayak	5745	38	36	35	38			3236	50	45	37	40	41	
13.Oak Ridge	58		3442	36	40			2932	46	44	32	35	35	
14.Sharp	6046	36	43	37	41	46	29	35	49	44	34	38		
15.Stuart	6246	40	44	37	41	43	36	40	52	45	39	41		
16.TLH	6148	35	46	40	44	46	32	33	46	47	33	36	41	
17.Wakulla	59		3746	38	43	39	34	37	48	48	37	40	42	
18.Watson	59		3844	37	42	39	34	36	49	46	37	39	41	
19.WCTV	60		3440	34	40			3236	49	43	34			
Mean	59.745.2	36.5	41.7	36.2	41.4	40.7	32.2	35.5	48.3	44.3	35.1	38.8	39.2	
St. Dev.	1.623.06	3.31	3.32	2.15	1.57	3.74	2.7	3.47	3.07	2.63	3.48	4.12	3.41	

	Feb-0215	16	17	18	19	20	21	22	23	24	25	26	27	28
1.Bellenot	4050	37	42	41	53	55	51			3743	46	31	26	
2.Binkley	34.943.3	28.9	28.4	33.7	42.3	50	40.8	47.1	27.1	29.7	35.6	25.2	13.3	
3.Brogan	4855	46	44	43	57			5749	45	46	49	34	29	
4.Canopy	3644	34			3844	47	42	43	28	33	37	27	19	
5.Chiles HS	39				4145	49	43	43	29	33	38	26	22	
6.Elsner	4047	41			3546	51	44	46	32	35	42	30	22	
7.Fiorino	39.243.7	34	33.2	38.4	46.3	51.1	44.1	37.7	31.2	34.6	39.6	28.3	21.8	
8.Fuelberg	4348	41	40	40	49	53	46	48	35	38	42	32	25	
9.Lanier	43.545	33	34.5	38.5	47			4445	31.5	35.5	41	29	19.5	
10.Lundy	3640	30	29	37	44	48	40	46	28	30	36		17	
11.McCool	35.841.2	35.2	32.9	33.6	45.5	49.3	43.2	35.1	29.8	33.4	38.1	24.8	19	
12.Nayak	4149	43	37	36	48	52	48	45	35	37	40	29	23	
13.Oak Ridge	3543	31	35	37	46	50	41	45	28	33	36	29	17	
14.Sharp	3645	33	39	39	47	51	44	46			3039	28	20	
15.Stuart			4040	40	50	54	50	46	37	40	45	30	25	
16.TLH	3746	32	32	41	45	51	44	48	29	34	38	32	18	
17.Wakulla	4052	41	39	38	50	57	48	48	32	37	41	32	23	
18.Watson	4146	40	38	38	46	52	45	47	33	37	40	32	24	
19.WCTV	39			3837	48	52	43	44	33	38	40	28	20	
Mean	39.146.1	36.5	36.4	38.2	47.3	51.3	45.2	44.9	32.3	35.6	40.2	29.3	21.2	
St. Dev.	3.453.94	5.04	4.47	2.52	3.43	2.5	4.13	3.56	4.43	4.26	3.53	2.58	3.74	

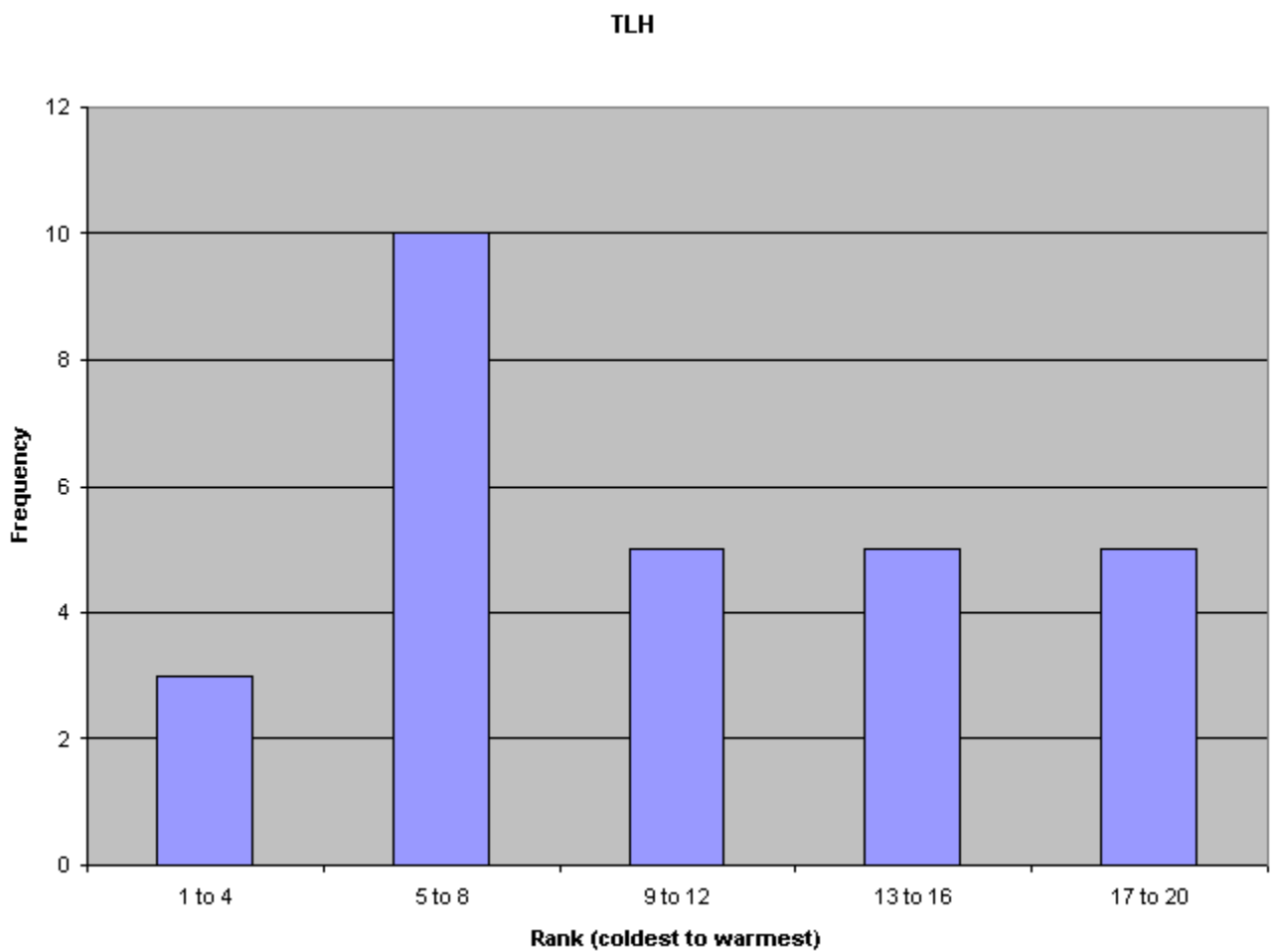
**Summary Data for February 2002**

TLH: National Weather Service

Average Minimum: 39.8  
Coldest Minimum: 18  
Date: 2/28  
Warmest Minimum: 61  
Date: 2/1  
Total Number of Freezes: 6

Days With Observations: 28  
Missing Days: 0

**Figure 3: Rank Histogram**



**Table 2: Frequency of Extremes**

Site	Total Obs	Coldest 4	Warmest 4	% in Coldest 4	% in Warmest 4
Bellenot	270	18	0	66.67	
Binkley	2820	2	71.43	7.14	
Brogan	270	26	0	96.30	
Canopy	2620	0	76.92	0	
Chiles HS	218	2	38.10	9.52	
Elsner	251	0	4.00	0	
Fiorino	284	2	14.29	7.14	
Fuelberg	280	14	0	50.00	
Lanier	273	1	11.11	3.70	
Lundy	2719	1	70.37	3.70	
McCool	2814	0	50.00	0	
Nayak	274	4	14.81	14.81	
Oak Ridge	2614	0	53.85	0	
Sharp	262	1	7.69	3.85	
Stuart	250	15	0	60.00	
TLH	283	9	10.71	32.14	
Wakulla	270	12	0	44.44	
Watson	270	4	0	14.81	
WCTV	220	1	0	4.55	